Missouri Pre-K Mathematics Standards

Missouri Department of Elementary and Secondary Education • Early Childhood Section

Introduction

The standards are broad descriptions of what most children should know and be able to do by the time they enter kindergarten. They are not a curriculum but are a framework for communicating a shared set of expectations for preschool children in the field of mathematics.

We realize some children will far exceed these standards; others will not enter kindergarten with the knowledge and experiences suggested in this document. Just as we recognize that different people bring different things to our society, we also recognize that variability in children is normal. The standards are not intended to be used to determine whether a child "is ready" to enter kindergarten. The standards are, however, goals for adults to use in supporting the mathematical development of preschool children. Available evidence indicates that the standards are appropriate for most children.

The standards were developed by a broad-based group of individuals whose backgrounds are representative of many facets of the early childhood community in Missouri. The standards are intended to be used in a variety of early childhood settings by a variety of people — parents, parent educators, child-care providers, Head Start and public/private school teachers, etc. They are consistent with current research and recommendations from other state and national initiatives.

It is our hope that the ultimate beneficiaries of this work will be our children, resulting in all children entering school ready to succeed.

Missouri Pre-K Guiding Principles

1. All children actively seek to comprehend the world in which they live. Given the opportunity to make choices concerning their activities, they acquire knowledge, skills and the ability to solve problems.

2. Children construct knowledge and values through interactions with peers, parents and other adults and through active exploration of the physical and social environment.

3. Young children's thinking contains predictable errors.

4. Early learning and areas of development interact and influence each other.

5. Families (parents) are the child's first and most important teachers.

6. Children exhibit individual differences in their development of competencies.

Missouri Pre-K Standards for Mathematics

Content Component	Process Standards
Number and operations	Uses number to show quantity Uses language to represent number of objects Solves problems using number Uses numerical representation
Geometry and spatial sense	Investigates positions and locations Explores shapes in the environment
Patterns and relationships	Recognizes relationships in the environment Uses patterns in the environment
Measurement	Makes comparisons Uses measurement
Exploring data	Collects, organizes and uses information

Process Standards ..... Competencies in the process of mathematical development.

Indicators ..... Milestones toward the development of competencies.

Examples ..... Observable behaviors children may exhibit in their mathematical development.

Guiding Principles ..... Principles of child development that guide Missouri early childhood practices.

Number and operations

Uses number to show quantity.

Number and operations: understanding of numbers, ways of representing numbers, relationships among numbers and number systems

Number: a unit belonging to a mathematical system used for counting, measuring, ordering and labeling; the meaning of a number word or numeral

Number sense: the ability to understand numbers, ways of representing numbers and relationships among numbers (Number sense is much more than counting — it involves the ability to think and work with numbers easily and to understand their uses (i.e., counting, measuring, ordering and labeling) and relationships.)

Numerals: conventional symbols that represent numbers (e.g., "1" is the numeral for "one")

Rote count: recite the names of the numerals in order or sequence (e.g., singing a counting song)

Count with understanding: attach a number name to a series of objects; to understand that the number spoken when tagging or touching the last object also identifies the total number in the group

Ordinal numbers: numbers that indicate the position of an object in a sequence (i.e., first, second, third)

Operations on numbers: basic number combinations and strategies for computing such as addition and subtraction

Quantity: how many units are in a set (i.e., an amount or the result of counting)

Everyday fractions: numbers that represent parts of whole objects in the child's environment (e.g., half a sandwich)

One-to-one correspondence: linking a single number name with one object, and only one, at a time

Estimate: make an educated guess as to the amount or size of something

Indicator	Examples
1. Shows interest in counting and quantity.	The child • uses fingers to indicate the number (e.g., holds up five fingers to show age). • repeats counting rhymes and singing games with numbers. • counts familiar objects (e.g., family members, friends, toys) although not always accurately. • asks how many.
2. Develops increasing ability to rote count in sequence.	The child • counts from one to 10 or beyond.
3. Counts objects with understanding.	The child • counts five items (e.g., blocks, crayons, cars) accurately. • hands one to five objects upon request (e.g., hands you three potatoes when you say, "Joe, hand me three potatoes.")

Number and operations

Uses language to represent number of objects.

Indicator	Examples
1. Uses language to compare number (e.g., more/less, greater/fewer, equal to).	The child • looks at his or her own and another child's blocks and determines who has more blocks. • compares raisins with a friend's and decides they have the same amount. • asks, "How many more do you have?"
2. Combines and names how many.	The child • puts the red, yellow and blue crayons together and counts how many crayons there are. • recognizes that three cars and two trucks is a total of five vehicles.
3. Separates and names how many.	The child • participates in finger plays, songs or stories such as "Five Little Monkeys" or "Five Little Ducks" that use backward counting. • plays with a plastic ball and bowling pins and can tell how many fell down and how many are left standing.
4. Explores everyday fractions.	The child • says (although not always accurately), "I have a whole orange," or "I have half an apple."

Number and operations

Solves problems using number.

Indicator	Examples
1. Names how many there are in a group (up to five objects) without counting.	The child • recognizes that there are two or three crayons in a box. • rolls a number cube and tells how many dots are on it without counting.
2. Uses one-to-one correspondence when counting objects.	The child • can count five blocks in a row, saying the number as each block is touched. • gets a carton of milk for each child at the table. • puts a cup with each napkin when setting the table. • holds an additional finger up for each number when counting orally.
3. Uses one-to-one correspondence to compare the size of a group of objects.	The child • compares two rows of blocks, two in one line and four in another, and can tell which one has more or less. • matches number of cars to a friend's and says, "I have more."
4. Estimates, then counts to verify the number of objects.	The child • while playing in the sand guesses how many cups it would take to fill a bucket and counts the cups of sand put in the bucket. • guesses how many pennies are on the table, then counts the pennies.

Number and operations

Uses numerical representation.

Indicator	Examples
1. Uses drawings to represent number.	The child • draws pictures showing size (e.g., short/tall) and quantity of family members. • creates a way to keep score during a game. • draws a picture to indicate number of objects or snacks.
2. Identifies numerals in everyday situations.	The child • selects numerals on the telephone, calculator or computer. • finds and names numerals in books or on signs.
3. Uses ordinal numbers (first, second, last).	The child • can identify position in a line of children (e.g., who is first, second, last). • can put three objects in a line and tell which object is first, middle or last. • tells the position of objects (i.e., first, second, last).
4. Writes some numerals.	The child • draws numerals in sand. • creates numerals with rolled clay or pipe cleaners. • tries to write how old he or she is. • tries to copy a telephone number.
5. Matches numeral with quantity.	The child • when playing a game with a spinner or number cube, correctly counts the spaces on the game board that match the numeral or symbol. • uses magnetic or flannel numerals to show how many marbles there are.

Geometry and Spatial Sense

Investigates positions and locations.

Geometry: the area of mathematics that involves shape, size, position, direction and movement and describes and classifies the physical world we live in

Location: where an object is in space

Orientation: the position or arrangement of an object

Position: the place where an object or person is in relation to others

Attribute: a characteristic or feature of an object such as color, size, shape, weight and number of sides

Spatial sense: children's awareness of themselves in relation to the people and objects around them; includes knowing boundaries, arrangements and positions

Shape: the form of an object

- Three-dimensional: objects that have length, width and depth; solid figures such as cubes, spheres and cylinders
- Two-dimensional: objects that have length and width but not depth; shapes such as squares, triangles and circles

Indicator	Examples
1. Takes objects apart and puts them together.	The child • builds with interlocking blocks. • puts lids on containers. • completes simple puzzles.
2. Uses actions and words to indicate position and location.	The child • moves self to show positions during play (e.g., under a table, in the tent, between friends). • uses objects to show position (e.g., puts the bears on/off/on top of/above/below/beside the box). • talks about objects that are on/off/under/in front of/behind/inside/outside/next to/between/etc. • says when reading *The Three Billy Goats Gruff*: "The big billy goat is on the bridge, and the troll is under the bridge."
3. Uses actions and words to indicate movement and orientation.	The child • moves self to show positions (e.g., up, down, forward, backward, around, through, to, from, sideways, across, back and forth, in a straight or curved path). • explains where objects in a room have been moved. • describes how to get to a location using landmarks. • follows a path or moves through an obstacle course. • draws paths or beginnings of a map to show location during play.

Geometry and Spatial Sense

Explores shapes in the environment.

Indicator	Examples
1. Investigates and talks about the characteristics of shapes.	The child • says, "A circle is round." • discovers some blocks stack and some blocks roll. • says that squares and triangles have corners and straight sides.
2. Creates and duplicates three-dimensional and two-dimensional shapes using a variety of materials.	The child • uses blocks to make other shapes or objects. • makes shapes with Play-Doh, pipe cleaners, string or yarn. • attempts to draw shapes and make pictures using shapes. • says after cutting the sandwich, "Look, I made a triangle (or rectangle) with my sandwich."
3. Identifies and names some shapes.	The child • points to or names simple shapes (e.g., box shape, ball shape, circle, triangle, square). • says, "The pizza is round. My piece is triangle-shaped." • says, "The flag is the shape of a rectangle."
4. Indicates if shapes are alike or different using one or more characteristics.	The child Three-dimensional shapes • says, "A bubble and an orange are both like balls (spheres)." • says, "A block (cube) is shaped like a box." • says, "This ball rolls, but this block does not." Two-dimensional shapes • says, "A triangle has three sides," or "A square has four sides." • says, "A circle is curved (round) like a hula hoop."

Patterns and Relationships (algebra)

Recognizes relationships in the environment.

Patterns and relationships (algebra): the primary objective is for young children to be able to identify and analyze simple patterns, extend them and make predictions about them

Match: find two objects that have at least one characteristic in common

Sort: place or assign objects in two or more groups on a basis of at least one characteristic

Regroup: place or assign objects in two or more groups using a different characteristic than was used the first time the objects were grouped

Order: arrange objects or numbers to show a progressive increase or decrease of a specific characteristic

Relative difference: the specific characteristic that differs among a group of objects (e.g., size)

Pattern: a sequence of colors, shapes, objects, sounds or movements that repeats again and again in a regular arrangement; patterns are a way for young students to recognize order and to organize their world

Extend: continue a pattern beyond what is shown

Indicator	Examples
1. Matches, sorts and regroups objects according to one or more characteristic.	The child • sorts plastic foods by size, color, shape or category. • matches objects that are alike (e.g., puts all of the two-hole buttons in one pile and four-hole buttons in another). • matches adult animals to their babies. • when playing Go Fish, matches all the cards with threes.
2. Orders things according to relative differences.	The child • sorts stuffed animals from smallest to largest. • talks about who is tall, taller, tallest. • arranges a group of blocks from longest to shortest.

Patterns and Relationships (algebra)

Uses patterns in the environment.

Indicator	Examples
1. Recognizes patterns.	The child • talks about color or pattern in clothing (e.g., says, "I have red and blue stripes on my shirt."). • identifies color patterns that repeat (e.g., red, blue, red, blue).
2. Duplicates and extends patterns.	The child • imitates a pattern of sounds and physical movements (e.g., clap, stomp, clap, stomp, ...). • continues rhythmic patterns. • completes the patterns in a story (e.g., says, "Brown Bear, Brown Bear, what do you see?"). • repeats a pattern according to size, color, shape, etc. while stringing beads. • predicts what comes next when an adult "reads" the pattern using simple vocabulary (e.g., car, car, boat, car, car, ____).
3. Creates patterns.	The child • creates simple patterns with beads or blocks according to color, size or shape. • creates simple patterns when drawing, coloring or painting.

Measurement

Makes comparisons.

Measurement: young children's intuitive notions of comparing volume, area, length and other attributes that they will eventually learn to measure; involves decisions about how much or how long

Compare: think about same and different; describe the relationship between two or more objects

Measurable features: characteristic or attribute of an object that can be quantified (represented with a number) such as size, shape, weight and number of sides

Sequence: an arrangement of events or actions in a progressive order over time

Indicator	Examples
1. Compares objects using measurable features.	The child • uses words to describe opposites (e.g., big/little, long/short, heavy/light). • chooses the largest snack. • says, "My bucket is heavier." • says, "This crayon is shorter."
2. Describes measurement.	The child • talks about an object being longer than another object. • uses a variety of language to describe measurement (e.g., shorter, taller, wider, bigger, heavier, lighter, holds more, hot, cold).
3. Orders three or more objects according to length or size differences.	The child • places ribbons in order by length. • puts cars in a row according to size. • puts pans (or measuring cups) inside each other.
4. Uses language associated with time in everyday situations.	The child • says, "Snack time comes after rest time." • says, "It's nighttime because it is dark." • says, "I eat breakfast in the morning." • says, "My birthday comes in the summer."
5. Anticipates, remembers and predicts a sequence of events.	The child • says, "I brush my teeth before I go to bed." • says, "We went to the library and then the grocery store." • recalls recent events and talks about them (e.g., says, "Yesterday we went to the zoo."). • describes the sequence of activities when going to the grocery store. • tells stories such as "The Three Little Pigs" with events in order. • points out when a familiar story is not told in the correct order.

Measurement

Uses measurement.

Indicator	Examples
1. Explores ways to measure.	The child • fills a container with solids or liquid (e.g., sand, ice cubes, water). • pours liquid from one container to another container. • sees how many blocks it takes to cover a sheet of paper.
2. Measures using objects.	The child • places a string next to an object to measure length. • uses the toy thermometer to measure the "patient's" temperature. • imitates using a ruler when helping dad.

Exploring data

Collects, organizes and uses information.

Exploring data: informal experience with data by collecting, organizing, representing and comparing the information

Data: information gathered to answer a question

Classify: sort or form groups by similar characteristics

Organize: arrange information in order to see relationships, often using graphs and charts

Indicator	Examples
1. Asks questions to gather information.	The child • asks, "What is your favorite color?" • asks, "What month is your birthday?" • asks, "What do you like to play outside?" • asks, "How many brothers and sisters do you have?"
2. Sorts and classifies objects into groups and sometimes explains how the grouping was done.	The child • puts objects together that have the same use (e.g., blocks, dishes, vehicles, clothes). • explains how the buttons were sorted (e.g., says, "I put the red buttons together.").
3. Evaluates information to answer questions.	The child • says two kids have birthdays in July. • says, "I have five trucks and four cars." • says, "More buttons are red."

Mathematics Development Committee

Margaret Albrecht, Parents as Teachers National Center
Diane Bauer, OACAC Head Start
Dee Beck, DESE
Karen Berding, Moberly School District
Gretchen Berhorst, DESE
Linda Biederman, Rockwood School District
Lana Brooks, DESE
Ruth Carmichael, Springfield School District
Julie Cowell, DESE
Ruby Crenshaw–Harriman, Daruby Early Learning Center
Jeannie Edwards, St. Louis Community College at Florissant Valley
Ruth Flynn, DESE
Terrie Foltz, Project Construct National Center
Sheri Griffin, Central Methodist College
Angie Koetting, DESE
Jane Kostelc, Parents as Teachers National Center
Val Lane, Children's Therapy Center
Peg Lee, Francis Howell School District
Amy Lightle, New Bloomfield School District
Bianca Love, Kansas City School District
Freda Markley, Consultant
Maurita McCarthy, Project Construct National Center
Twanna McDaniel, Asia's Learn and Play House
Becky Myers, Project Reach
Darin Preis, Head Start Collaboration Office
Kellie Quinn, LIFT
JoAnne Ralston, Department of Health and Senior Services
Tammy Randolph, Southeast Missouri State University
Cindy Reese, Division of Family Services
Sharon Schneeberger, Project Construct National Center
Cindy Segalhorst, Francis Howell School District
Jodi Trautwein, Southeast Missouri State University
Theresa Villmer, DESE
Susan Whiting, DESE
Lisa Willoughby, Cole Camp School District
Kathi Winkler, Hickman Mills School District
Maureen Zupanec, Lee's Summit School District

Mathematical Concepts Defined for Early Childhood

Definitions for mathematical concepts found in each of the Missouri Preschool Mathematical Content Components can be found on the page where the first process standard of each content component is described. The definitions were gleaned from the following resources.

Copley, J.V. (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children.

Fromboluti, C.S., and Rinck, N. (1999). *Early childhood: Where learning begins: mathematics*. Jessup, MD: U.S. Department of Education.

Irons, R.R. (2002). *Growing with Mathematics: Pre-K*. Bothell, WA: Wright Group/McGraw Hill.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Waite-Stupiansky, S., Church, E.B., Feeney, L., Karnes, M., Katz, L.G., and Ward, C. (1992). *Learning through play: Math, a practical guide for teaching young children*. New York: Scholastic.

Wolf, D.P., and Neugebauer, B. (Eds.). (1996). *More than numbers: Mathematical thinking in the early years*. Redmond, WA: Child Care Information Exchange.

Special thanks to:

Department of Elementary and Secondary Education (DESE)
Department of Health and Senior Services
Department of Social Services
Missouri Head Start Collaboration Office
Parents as Teachers National Center
Project Construct National Center

Missouri Department of Elementary and Secondary Education
Early Childhood Section
P.O. Box 480
Jefferson City, MO 65101
(573) 751-2095
dese.mo.gov

"Making a positive difference through education and service"